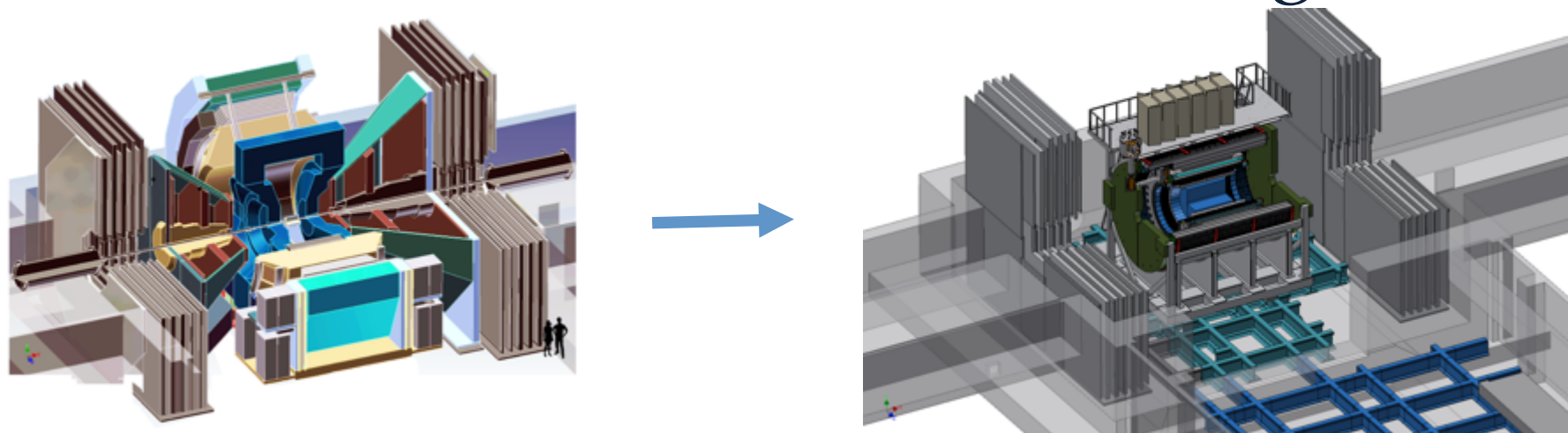


Decommissioning PHENIX and sPHENIX Installation and Integration



Director's Cost and Schedule Review
November 9-10, 2015

Decommissioning Specifications/Requirements



- **Remove and disposition** all PHENIX carriages and all PHENIX detector subsystems and services comprising, salvage high value components
- **Cap off** PHENIX gas system supply piping for future use
- **Re-use** as much Infrastructure as possible
- **Retain** shield walls, moveable and permanent and Muon Identifier (MuID) Steel
- **Remove** PHENIX Current beam pipe, replace with temporary beam pipe for future RHIC runs without PHENIX

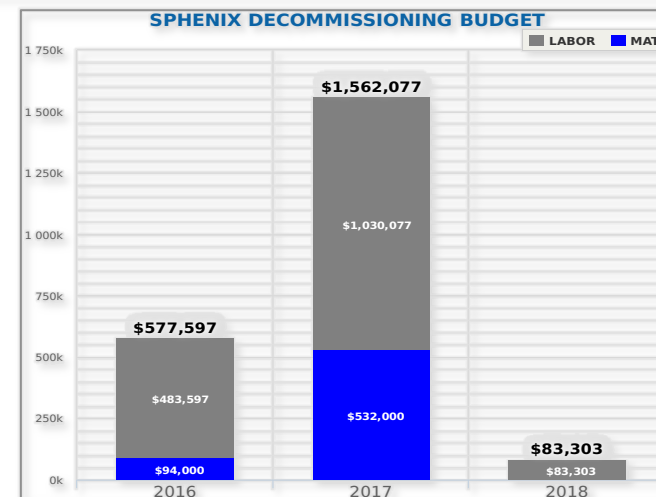
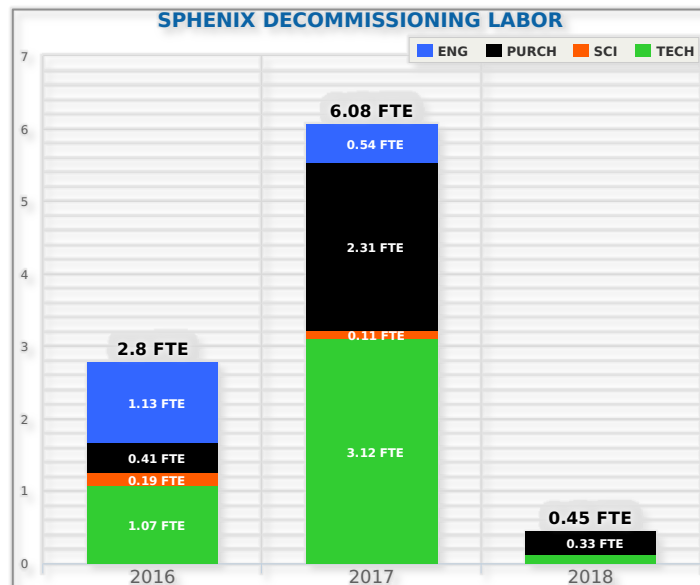
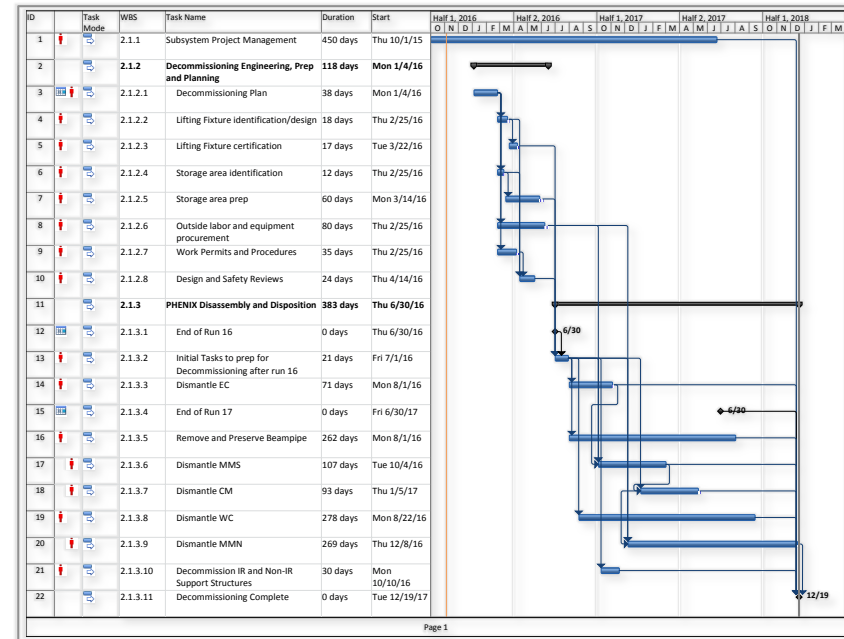
Decommissioning Description

- **Obtain permission to Decommission PHENIX**
- **Prepare for Decommissioning:** work plans, determine disposition of Non-PHENIX/DOE equipment, re-certify lifting fixtures, contracts for disassembly and disposal, Set up work/storage space for salvage parts
- **Initial Tasks:** Purge, disconnect, remove collars, move South Magnet (MMS) south, move EC to Assembly Hall (AH), start beampipe removal
- **Disassembly and Disposition:** For each major segment of PHENIX (EC,), strip off services, remove racks, remove & dispose detector subassemblies, disassemble and dispose of frames, structural supports, access and platforms
- **Other :** Strip back and cap off services, decommission in place Infrastructure systems to be (or potentially to be) modified in the future Muon Identifier steel and detector panels, remove beampipe sections to safe storage for later modification and installation in sPHENIX. Install temporary beampipe and supports for Run 17 and Energy Scan runs.

Decommissioning Schedule and Resource Requirements

Key Schedule Dates

4/3/16 Approval to Decommission
 6/30/16 End of Run 16/
 begin Decommissioning
 1/1/17 run 17 Begins,
 IR is closed for run
 6/30/17 Run 17 ends
 12/19/17 Decommissioning complete



Decommissioning Cost and Schedule Drivers

- **Major Cost Drivers**

- Lifting Fixture refurbishment/replacement
- Storage area prep/infrastructure
- Purchased services and rental equipment (cranes) for structural disassembly
- Technician Labor

- **Major Schedule Drivers**

- Approval to decommission
- Availability of technician support
- RHIC Run 16 (last PHENIX run, no access to IR)
- RHIC Run 17 ((PHENIX partially decommissioned, no access to IR)
- Availability of purchased labor/services

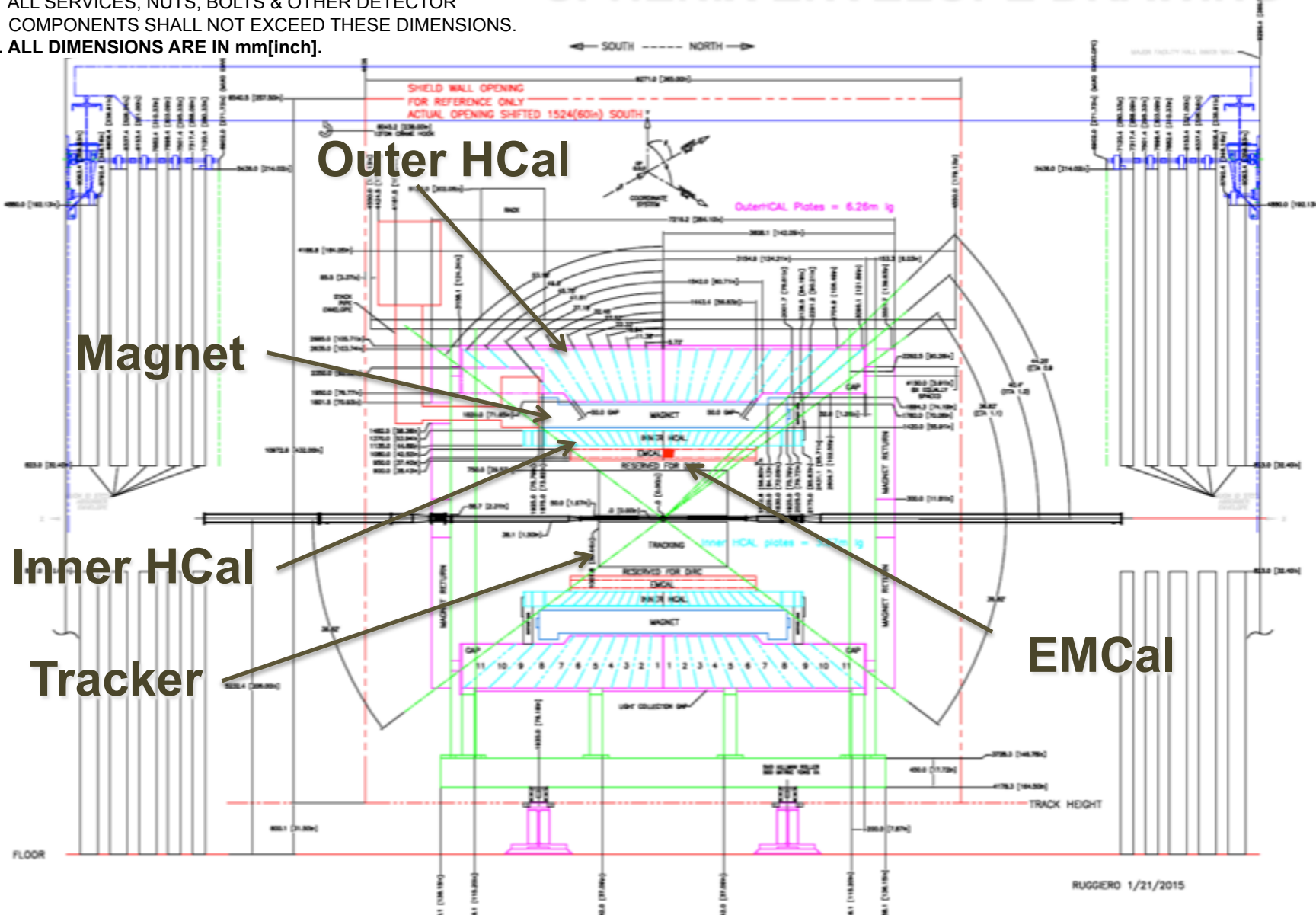
Specifications/Requirements: sPHENIX Integration and Installation

- **Integration**
 - All components assembled onto a single support carriage
 - Carriage supports Outer HCal, Flux return end caps, access and service platforms
 - Outer HCal supports Magnet, Inner HCal and Tracker, independently
 - Inner HC supports EMCal
 - Establish stay clear regions between subsystems
- **Installation**
 - IR & AH Floor Loading Limits: 4000 psi, max
 - Positional precision: 0.5 mm,
Angular precision: 10 milliradian (roll, pitch and yaw)
 - Installation to be accomplished in the Assembly Hall (40 ton and 5 ton overhead cranes)
 - Assembly to be prepared for magnet mapping in Interaction Region (IR) after Outer HCal is installed, then returned to Assembly Hall to complete detector installations.
 - Overall size requirements The complete sPHENIX assembly, including magnet valve box stack and all electronics racks, must fit through the sPHENIX sill on the existing sPHENIX rail system

SPHENIX ENVELOPE DRAWING

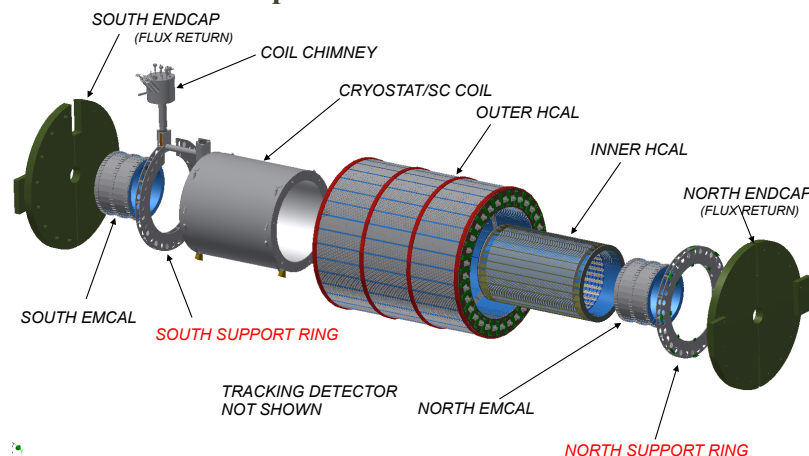
NOTES:

1. NOTED DIMENSIONS ARE MAXIMUM SIZE.
ALL SERVICES, NUTS, BOLTS & OTHER DETECTOR
COMPONENTS SHALL NOT EXCEED THESE DIMENSIONS.
2. **ALL DIMENSIONS ARE IN mm[inch].**



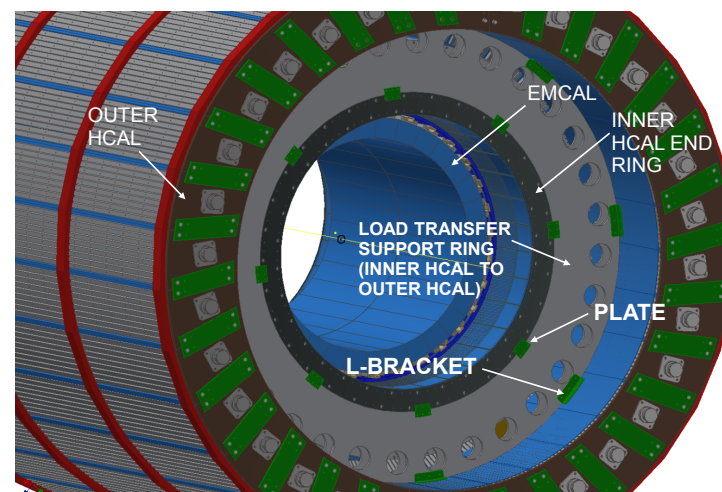
Integration and Installation Design

Detector Major Components Exploded View



3D modeling of detector components

Load Path from Inner detectors to Outer HCal



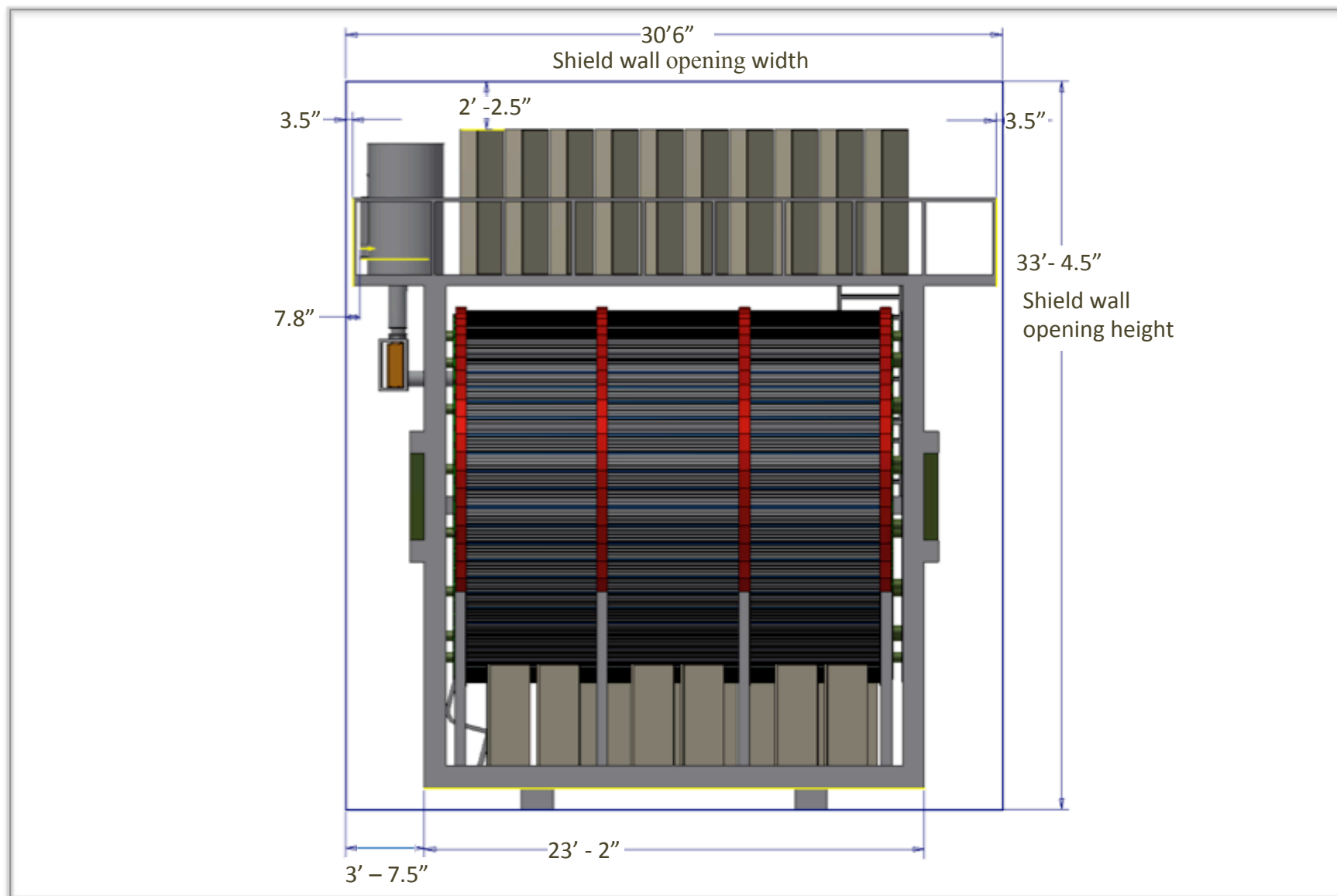
Integration & Installation Design Drivers:

- Subsystem Design
- Existing Infrastructure (shield wall opening, Crane coverage and limits, rail layout)
- Minimum material in active areas
- Access for repair, maintenance, upgrade
- Safety
- (Future upgrade capability)

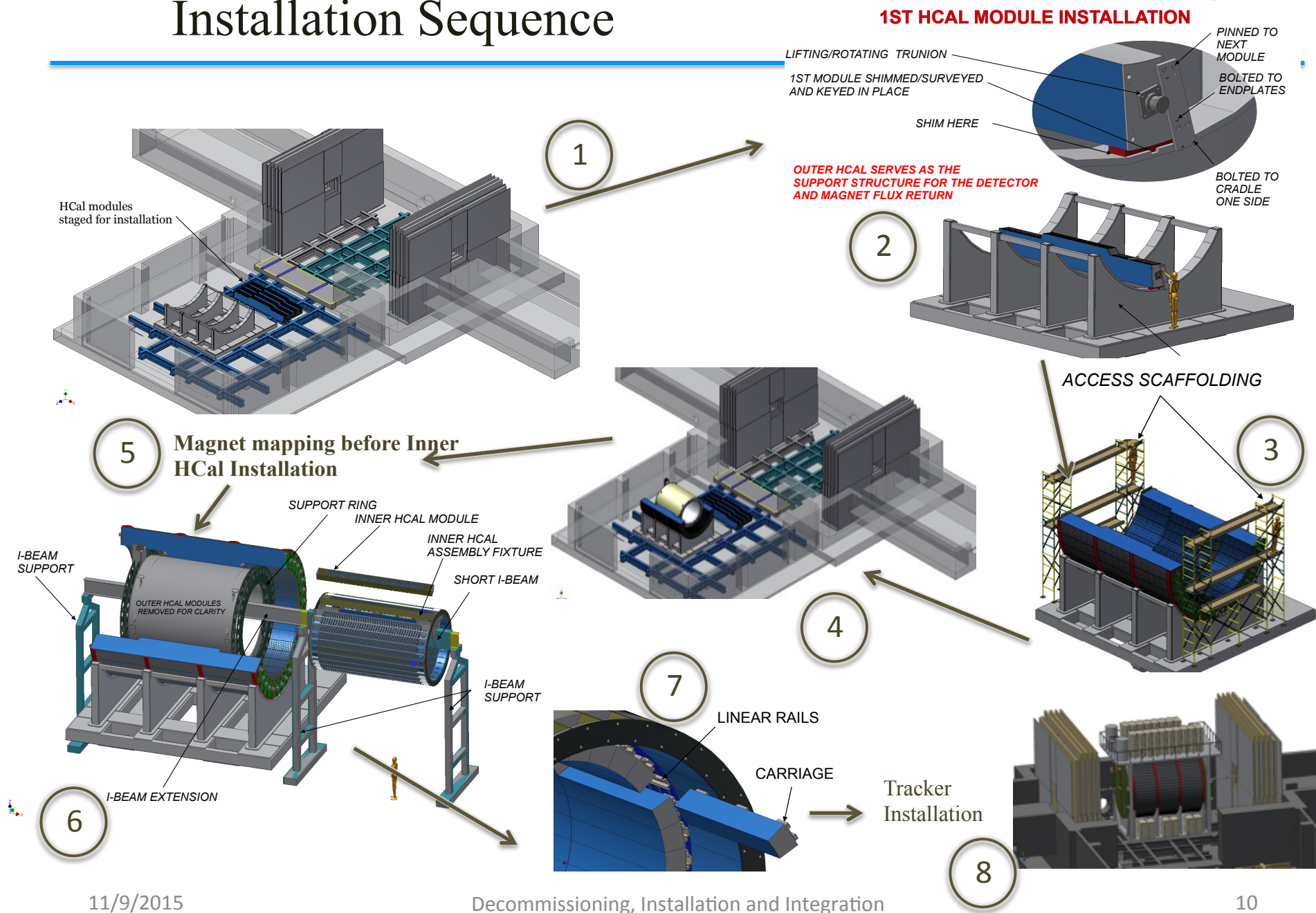


Inner HCal 1/2 sector mockup
(dimensionally accurate/non-functional)

sPHENIX Overall Size and Shield Wall Opening



Installation Sequence

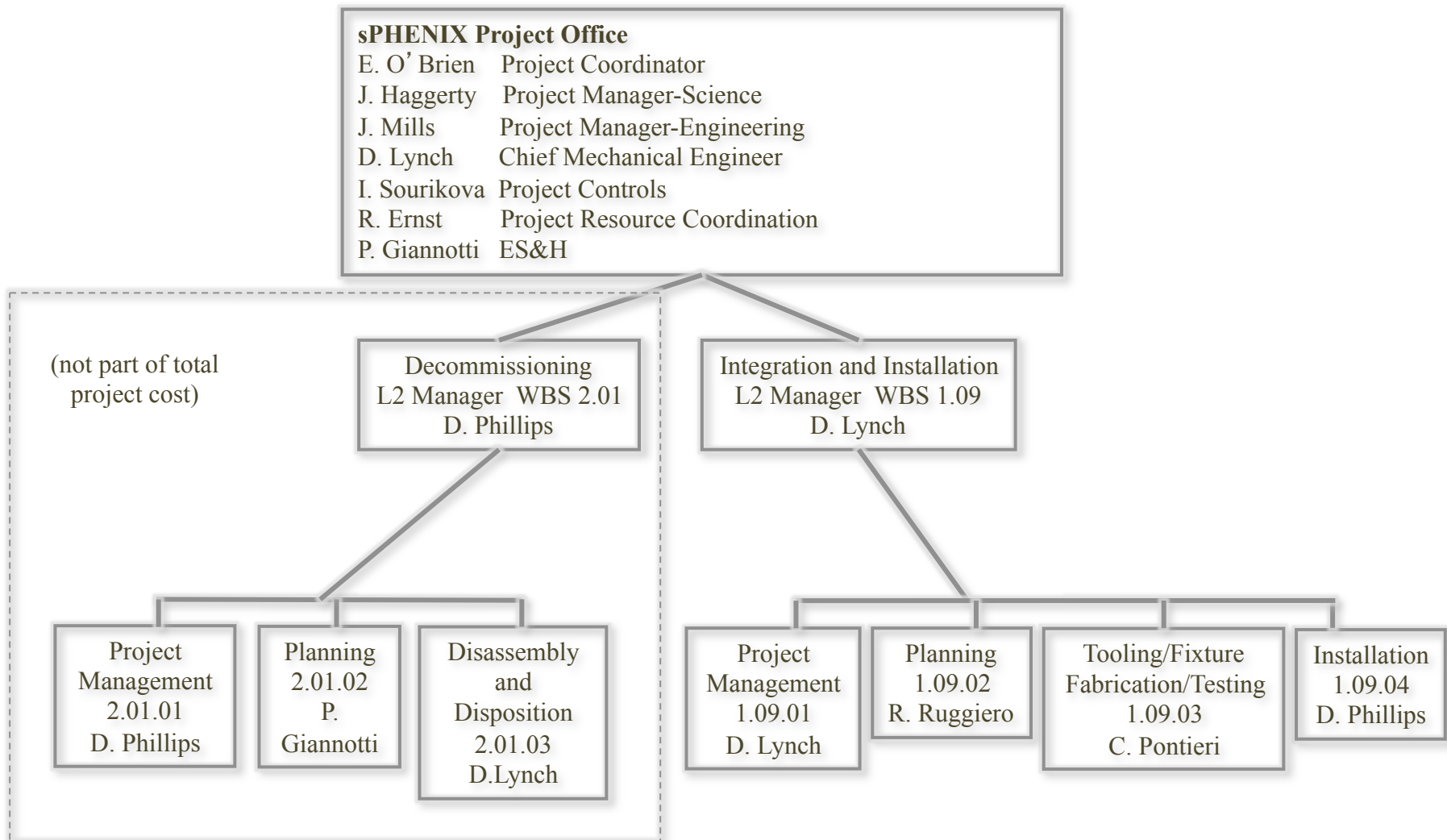


Integration and Installation Cost and Schedule Drivers

- **Major Cost Drivers** (Does not include detector sections and equipment produced as part of detector subsystems [e.g. handling fixtures])
 - Assembly, holding and lifting fixtures particularly the Outer HCal indexed lifting fixture, the Inner HCal assembly and installation fixtures, and the EMCal indexed lifting fixture
 - Alignment/ survey fixtures
 - Scaffolding and temporary HCal internal support structures
 - (Note: cost of carriage and structural support integration components is in the infrastructure subsystem)
 - Technician Labor

- **Major Schedule Drivers**
 - Infrastructure completion (which in turn is dependent on decommissioning completion)
 - Delivery of carriage components and internal structural support components
 - Delivery of Outer HCal sectors, Magnet, Inner Hal, EMCal and Tracker sections
 - **Magnet mapping (adds 4 months to schedule)**
 - Commissioning

Decommissioning, Installation and Integration Organization



Installation Schedule and resource Requirements

Key Dates

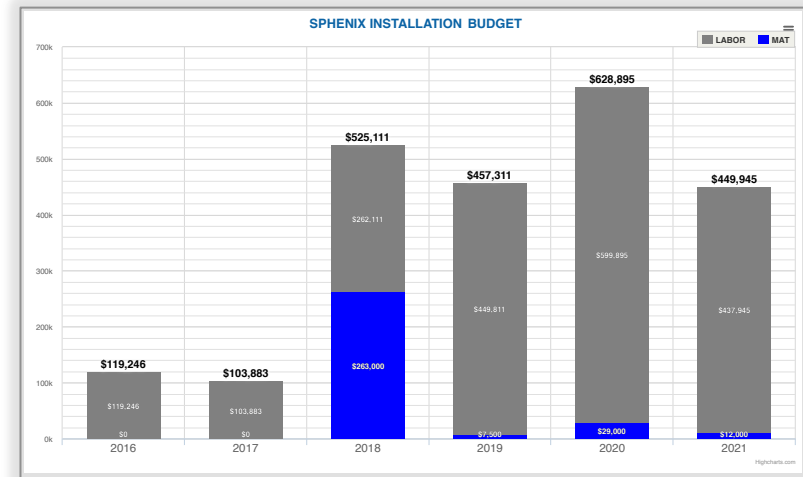
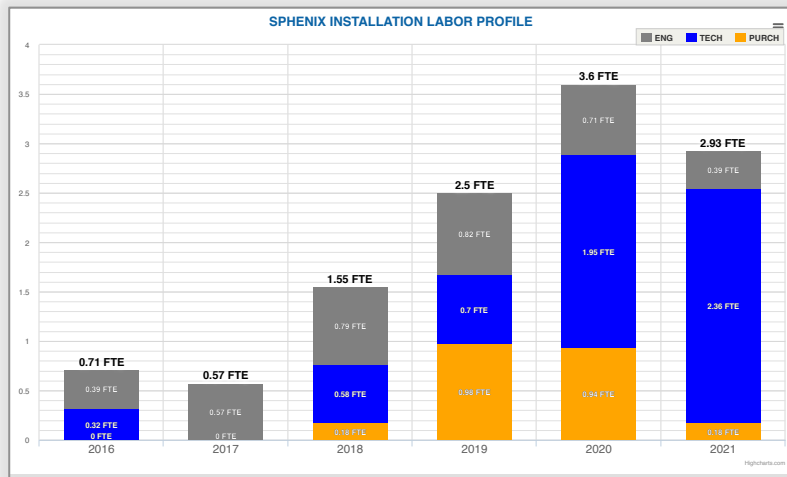
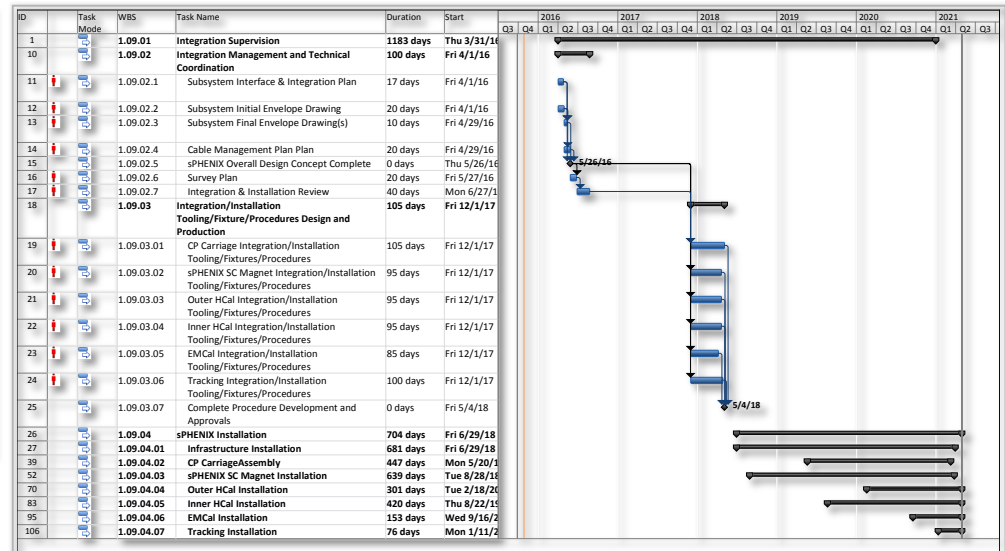
8/22/17 Decommissioning of PHENIX complete

6/29/18 Funds available to procure base components

5/20/19 Base components ready for assembly

7/20/20 Magnetic measurements/mapping (adds 4 mos)

3/4/21 Installation, sPHENIX complete ready for commissioning



Decommissioning, Installation and Integration: Technical Status

- **Decommissioning –**
 - All requirements are well known
 - Planning, procedures and scheduling are in progress
 - Collection and evaluation of existing subsystem lifting and handling fixtures in progress
- **Integration and Installation**
 - Pre-Conceptual Design is evolving in parallel with detector subsystem design
 - Ongoing structural analyses (FEA) to test adequacy of integration/structural support concepts
 - Evaluation of purchased component procurement tradeoffs in progress
 - Evaluation of cost and schedule sequence tradeoffs in progress
 - Evaluation of competing installation fixturing design tradeoffs in progress

Alternatives Considered

- **Decommissioning**
 - **Salvage vs. bulk recycle**– *high value items requiring minimal additional efforts to be salvaged all else to be bulk recycled*
 - **Cutting large MMN components in IR** vs. bringing in large crane and hauling out large MMN pieces – *cutting in IR is more cost effective*
 - Removing Muld Steel vs. retaining – *retaining eliminates costly removal and **is essential** to background shielding for sPHENIX detectors*
- **Integration and Installation**
 - Support base: **multiple carriages** vs. single carriage – *Single carriage more cost effective easier to align*
 - Pole Tips: separate structural support vs. common support with magnet; sliding (horizontal and vertical flux return end caps vs. hinged) – *hinged is safer, less cost*
 - EMCal assembly: independent support structure for entire detector vs. rails on Inner Hal for each sector – *rails is less cost and less material in active areas*
 - Magnet Stack: Opening in middle of Outer HCal vs. extension to move valve box out of active area – *Extension maintains greater uniformity in Outer Hal, simpler less costly design*
 - **Magnet test: in Assembly Hall (AH)** vs. in Interaction Region (IR) – *In IR is less complicated does not require duplication/relocation of infrastructure*
 - Inner HCal Installation Fixture - *several options being evaluated*
 - **Inner HCal Assembly away from AH** then transported to AH for installation vs. assembly and installation in AH – *assembly in AH is less complex and does not require additional assembly facilities and infrastructure*
 - **Overall assembly in IR** vs. AH – *assemble in AH, Crane loadings in IR too low, less space to work*

Decommissioning, Integration and Installation Issues and Concerns



- **Decommissioning**

- Waste management of **activated steel**
- Disassembly of the **MMN** in the IR
- Disassembly of the CM in the AH: Central magnet components exceed 1008 **crane capacity**
- Final disposition of scrapped materials
- In-house vs. **outside contractors** for disassembly of large structures

- **Integration and Installation**

- Alignment **tolerances** for individual detector subsystems – Is precision specification appropriate
- Magnet **mounting** & alignment
 - intrinsic to magnet: adapting SLAC mounting feet to sPHENIX Outer Hal
 - **Field calculation** to determine acceptable tolerances
- Magnet Mapping: do we need Inner HCal installed?
- Details of Inner HCal installation fixture design
- EMCal alignment provisions
- **Tracker** assembly design details
 - What are alignment requirements?, Install before or after beampipe?, Install as a unit or in sections?